

Chemical Engineering 374

Fluid Mechanics

Introduction



Announcement

**ChE 374 (Fluids, i.e. this class) will
now be taught both fall and winter
semesters**



Family



Course Details

- TAs: Corbin, Connor, Devin, Phillip
- Daily Concept Quizzes (5%) **READ!!!**
- Daily Homework (15%)
 - Late homework accepted for 1 week at 50%
- Weekly Open-Ended Problems (10%)
- Special Project (10%)
- 3 Midterm exams (40%) 1 handwritten pg notes
- Final Exam (20%) 12/12/16 @2:00PM
- Must attend two college lectures



About Fluids

- This course is “different” – very physics based
- Fluids is HARD - lots of new concepts/equations
 - Based on 4 balances:
 - Force, momentum, mass, energy
 - Application of Math 302/303 (or equiv.)
- MANY future courses will be based on these concepts : H&M, UO Lab, Plant design, etc.
- You are not in this alone!
 - Dr. Memmott
 - Classmates
 - Heavenly Father & the Spirit



Hard Work + The Spirit

Face the future with optimism. I believe we are standing on the threshold of a new era of growth, prosperity, and abundance. Barring a calamity or unexpected international crisis, I think the next few years will bring a resurgence in the economy as new discoveries are made in communication, **medicine, energy, transportation**, physics, **computer technology**, and **other fields** of endeavor.

Many of these discoveries, as in the past, will be ***the result of the Spirit whispering insights into and enlightening the minds of truth-seeking individuals***. Many of these discoveries will be made for the purpose of helping to bring to pass the purposes and work of God and the quickening of the building of His kingdom on earth today. With these discoveries and advances will come new employment opportunities and prosperity *for those who work hard and especially to those who strive to keep the commandments of God*. This has been the case in other significant periods of national and international economic growth.

-Elder M. Russell Ballard

BYU Idaho Commencement Remarks

April 6, 2012



Better Learning

“Make it Stick, The science of successful learning”

- Based on hundreds of rigorous studies
 - Re-reading/highlighting is least effective!
 - Most effective learning methods include:
 - Grouping knowledge into “concepts or principles”
 - Delayed Recall (i.e. quizzes/self quizzes)
 - Solving unfamiliar problems
 - Struggling through HARD problems
 - Tests as learning tools, not measurements



Wind, Weather, Environment



Recreation

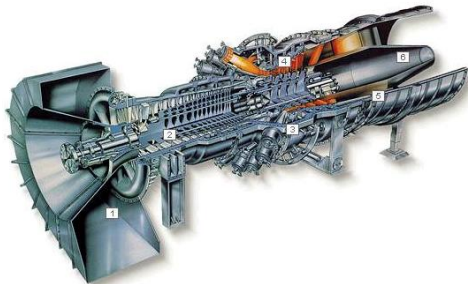


Daily Life

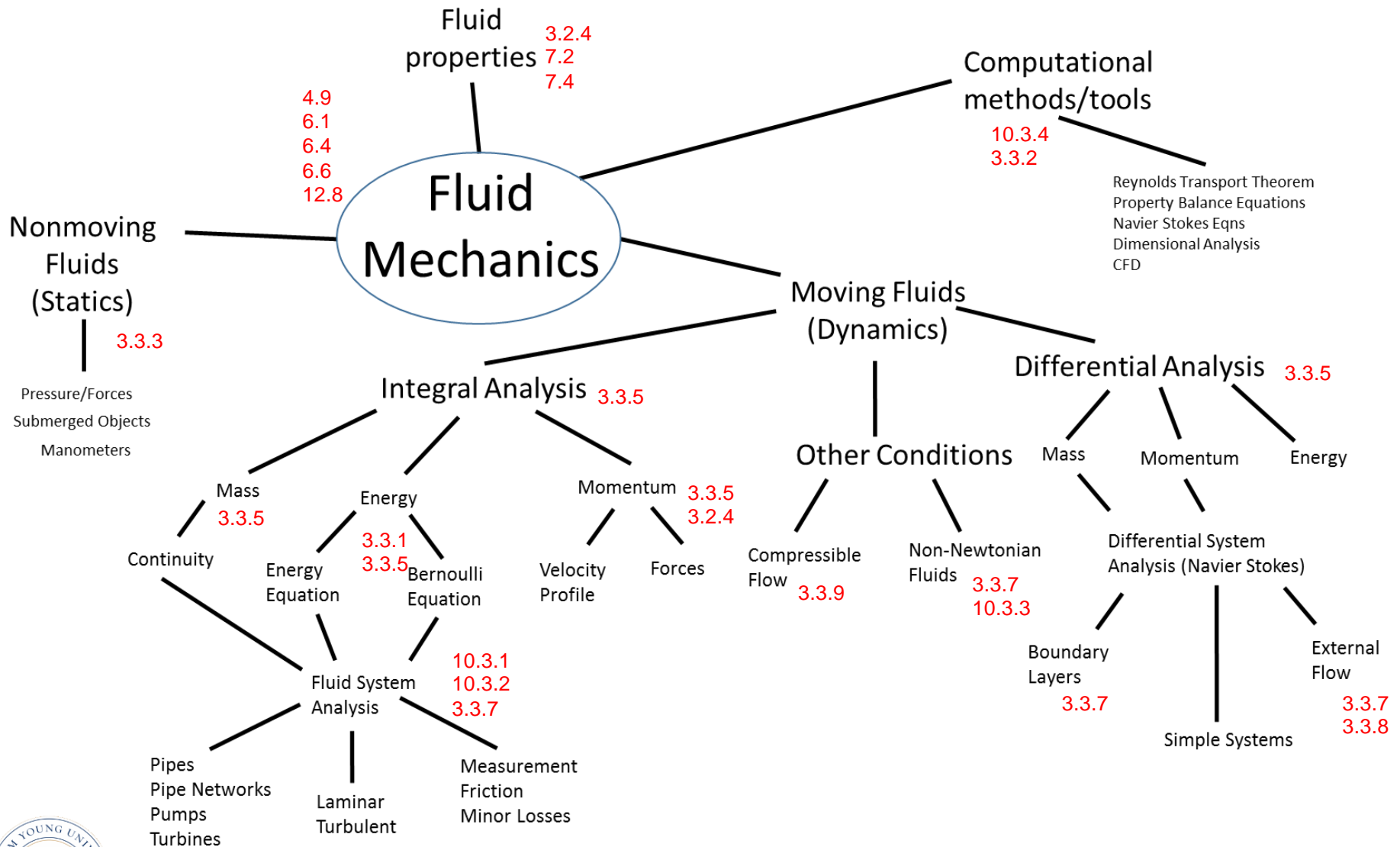


Engineering

- Flow rates
- Pressure drops
- Velocity profiles
- Pipe design
 - Size, length thickness
 - Pipe networks
- Combustors
- Valves
- Pumps
- Turbines
- Heat exchangers



The BIG Picture



Red text = course competencies



Open-Ended Problems (OEP)

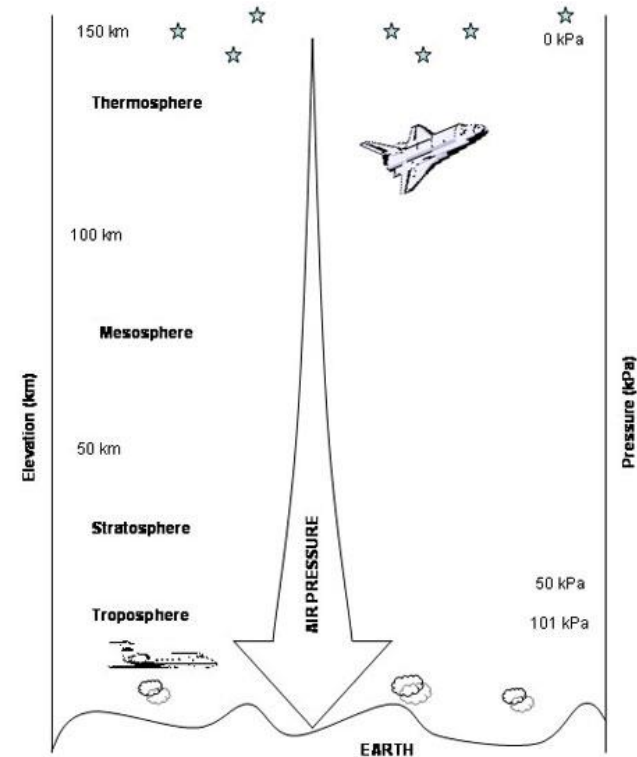
- The world is made up of open-ended problems:
 - Who should I marry?
 - What is the average flight velocity of a coconut-laden swallow?
 - What is the best catalyst for a TCC?
 - How far could Aragorn safely toss a dwarf?
 - What do I need to power a geothermal microwave emitter?
 - What is the best investment strategy?
 - How can I optimize my errands and child transportation?
 - Should we resurrect the dinosaurs?
 - What is the best thermodynamic system for a nuclear power plant?
 - Seriously... where are the 5th and 6th infinity stones?



- No “exact, right” answer, though you can provide a reasonably close solution, and develop understanding.
 - Key is to know HOW to solve, then check results
- School vs. the world (OEPs) – like swinging a baseball bat

Methodology

1. Find what the problem actually asking for
2. Draw a sketch of the problem region of interest
3. What physical laws/phenomena apply to the problem?
4. What equations can be used to represent the problem?
5. What variables/values do we know? What do we **need** to know?



Methodology (continued)

6. What assumptions need to/can be made?
7. What physical properties should be used?
8. Calculate the answer
9. **MOST IMPORTANT: CHECK AND VERIFY THE ANSWER!!**
 - Sanity check – is it reasonable?
 - Max/min check – is the range of solutions reasonable
 - Redo without an assumption – was assumption valid?
 - Check against known value – is it similar to other related problems?
 - Increase complexity and solve again – was simplicity justified?
 - Many, many, more!



Open Ended Problem I (Clip)



Open Ended Problem I

- Clearly, Dr. Jones realized while standing in the temple in Peru that he mistakenly estimated the weight of the gold statue while in his office at Marshall College (in Bedford Connecticut). He filled the bag based on his estimates outside the temple, though when he stood before the statue he realized his mistake. He tried to remedy this by removing a large handful of sand, but he didn't remove the correct amount. How many handfuls of sand **should** he have removed in order to have prevented his running a 400 meter dash in front of a giant boulder?
- Due Wednesday, 9/7 at beginning of class
- Methodology is more important than answer, and checking/analysis of answer is nearly as important as the methodology



Example OEP

- Should you buy a goose that lays golden eggs for \$10,000? (assume half of food by mass goes to making eggs)
 - What is being asked?
 - Picture?
 - Laws/Phenomena? Equations?
 - Values? Variables?
 - Assumptions
 - Solve
 - Check



Example OEP (II)

1) What is the mass of gold production?



3) Mass Balance!

Example OEP (III)

4) What to assume:

- Price of Gold
- Cost of food
- amount of food/day
- size of eggs
- solid or hollow eggs?
- etc.

- Use Google to find, document sources

5) assume m_{in} , determine $m_{out} = \frac{1}{2} m_{in}$ & calculate income/day

6) Is this reasonable? egg size/frequency
lifetime of goose vs. food

